SKILL DEVELOPMENT AND ITS RETENTION

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THESIS

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by

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The primary concern over the literacy of the sailor is the rapid increase in the complexity and technology of the

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This thesis reviews current training procedures and learning theory which might be applicable. It then suggests modifications of current training practice to improve the capabilities of the aircraft maintenance technician.

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Skill Development and Its Retention

by

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ABSTRACT

Recent popular opinion describes today's new recruit as less intelligent than those recruited before the advent of the all volunteer force (AVF). This is not the case. The status of literacy in the navy has remained almost constant with a slight improvement since the AVF.

The primary concern over the literacy of the sailor is the rapid increase in the complexity and technology of the maintenance requirements. As this complexity and technology continues to escalate, the need for optimal training increases.

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Current popular opinion considers today's new recruit as less intelligent than those recruited before the advent of the all volunteer force (AVF). This is not the case. The status of literacy in the navy has remained almost constant with a slight improvement since the AVF [Ref. 1].

The primary concern over the literacy of the sailor is the rapid increase in the complexity and technology of the maintenance requirements. As this complexity and technology continues to escalate, the need for optimal training increases. The current maintenance training programs in the Patrol Squadron (P-3) community is considered to need improvement as the gap between the system's technological level and the repairman's knowledge continues to grow.

Little can be done immediately and effectively to correct the training external to the P-3 community. However, it is important that the most effective training possible be accomplished.

A. PROBLEM

As the technology of naval warfare has increased in complexity, the difficulty in training and maintaining a sailor's skills and proficiency has become increasingly evident. The difficulty has been accentuated by increases in the rate of technology change, and by the constant shuffling and reshuffling of manning levels. The need for

continual training of the maintenance personnel has intensified in the P-3 community.

In the past year, a significant change in the manning level of the maintenance personnel in a P-3 squadron has generated extreme aircraft readiness problems. The personnel assignment is based on the squadron manpower document (SQMD) using mathematical formulae incorporating an industrial-managerial approach to manpower requirements [Ref. 2].

The most critical perceived problems which result are:

1. Improving the quality of incoming non-supervisory personnel;

2. Making the incoming, non-prior experienced P-3 supervisor a suitable replacement for his predecessor; and

3. Providing an in-house follow-on training program directed toward all members of the maintenance department for the purpose of developing a suitable level of proficiency.

B. PURPOSE

In the high visibility of a naval aircraft community, the shortcomings of the aggregate commands pose a serious problem to naval warfare. In the case of the P-3 community, very significant ramifications will result if the current situation is not rectified.

It is the purpose of this research to produce a potential training progression. In order to do so, a look at skill learning and skill deterioration will provide the basis for recommended changes in initial and follow-on training. Although little research material is available, some

substantial theories have been developed in both learning theory and deterioration theory. The integration of these theories with some original concepts will aid in identifying the potential problems in training and maintaining a competent performer. A further analysis of the strengths and weaknesses of suitable training methods for achieving longer-lasting skills will assist in the final production of skill training. The intent is not to determine training subject matter, but to formulate more effective methods of training.

C. BACKGROUND

During the last three years, significant changes have occurred within the P-3 community. Perhaps the most critical change has been in the manning levels within the maintenance department. A recent study conducted by Rear Admiral Prindle showed that supervisory personnel had been reduced by an average of twenty-five men with an associated average increase of twenty-three laborers. A further study disclosed during the year that an average of sixty percent of the incoming supervisory personnel had no P-3 experience [Ref. 3].

The above figures are significant because the composition of the squadron went from 144 authorized supervisors (E-5 and above) to 119 [Ref. 4]. The supervisors possess the most experience and the most knowledge of the systems that must be repaired. When the replacement supervisors have no prior P-3 experience, but possess the technical knowledge of the rate, the time to train them in the intricacies of the systems

and to perform as supervisors is long and critical. The total knowledge of a work center is reduced immensely if the supervisor is transferred and replaced by a non-systems experienced replacement. Shifting efficiency from shop to shop as supervisors are changed is not uncommon. It is important that in the case of non-experienced supervisors, an intensified indoctrination training program be started so that they may improve their skills as rapidly as possible.

When the number of non-supervisory personnel (E-4 and below) was increased from 143 to 166, the work center supervisors were required to provide indoctrinational as well as technical training in order to prepare the new workers to be productive performers. A new man requires close observation and constant assistance on the job for a considerable period of time before he achieves the competence to perform unassisted.

D. TRADITIONAL TRAINING

When the squadron receives a new man, he will ideally be able to perform as an experienced and efficient worker. Unfortunately, this is rarely the case. However, the navy has attempted to train sailors to perform effectively. From the time an individual enters the navy, a continual training evolution begins.

The new recruit is detailed to recruit training where he receives an introduction to military life. The length of recruit training has varied through the years but it is normally several weeks in duration. The recruit who is

destined for the aviation field has two avenues to travel through the pipeline which eventually leads him to a squadron. Once this journey begins, it is important that he receive the most effective training available. He should be technically oriented so that he can perform at the expected level.

The first avenue of travel sends the recruit to the Airman Apprentice training program. Here he is introduced to the general structure and functions in the aviation maintenance field. This program commences immediately after completion of recruit training and is very general in content. Following Airman Apprentice training, he is detailed to the squadron via the local training activity. After the authorized leave period and allocated travel time to reach the new duty station, the new airman reports to the Fleet Readiness Aviation Maintenance Personnel (FRAMP) training program. The FRAMP is the common point where the training avenues become parallel.

The second avenue sends the recently graduated recruit to a class "A" school, which provides intensive training in a specific field of maintenance but not to a specific type aircraft. This training is conducted predominantly by programmed texts, classroom lectures, demonstration, and on-the-job training. When he has completed this course, he is authorized a leave period and travel time prior to arriving at the FRAMP [Ref. 5].

The major difference between "A" school and Apprentice Training is that, once the airman attends the "A" school, he is locked in to a specified rating and will work only in that field. Some examples are aviation structural mechanic, avionics technician, or avionics electrician's mate. After completing Apprentice Training, the airman is not designated to a specialty and will not know his specified field until he is actually assigned. This assignment is based upon the manning level of the squadron and is contingent upon the number of personnel presently assigned.

At the FRAMP, the non-designated airman receives four weeks of training to familiarize him with P-3 handling, ground support equipment, and squadron organization. This is supplemented with eighty hours of practical job training (PJT). The designated airman receives the same package with an additional specified training course in his rating [Ref. 6].

Now that his pipeline training is complete, the new airman finally arrives at his ultimate destination, the squadron. His energies have been spent in training commands for the past several months and he is now ready for a work center assignment. Unfortunately, the quadron is responsible for providing the station with personnel to work at support facilities requiring non-designated, non-supervisory assignments. Consequently, the new airman's first three months of assignment to the squadron are spent at another activity precluding him from a work center assignment [Ref. 7]. After this, his ultimate

goal is reached and he is assigned to a work center where he begins work as an aircraft repairman.

The airman is permanently assigned to a squadron where he receives follow-on training based on the priorities of the command. That is, actual maintenance of aircraft will take priority over training. The normal trend is to use the on-the-job training and the navy's professional qualification standard (PQS) training as the main source of follow-on training.

The following chapters present a theory on skill learning and skill deterioration which provides the fundamentals to show the shortcomings of the traditional pipeline training procedures and follow-on training.

II. LEARNING THEORY

Before attempting to organize a training program, a study of learning and memory characteristics should be undertaken in order to produce the most beneficial program possible. Although little research has been conducted in the field of learning and memory theory, a simple hypothesis can be developed through a graphical progression which defines the need for training and continued training.

Skill retention studies have shown that retention variables can be separated into four major categories: (1) amount of training, (2) duration of retention interval, (3) task organization, and (4) task environment. Perhaps the most important factor in the prediction of retention of skills is the final level of skill acquisition prior to non-utilization. Skill deterioration will begin at the level of skill acquisition and continue at an unknown rate that is inversely related to the non-utilization time [Ref. 8].

Perhaps the most profound point from Ref. 8 is the suggestion that training/retraining programs should be based on previously identified critical performance dimensions. Silvern proffered the same recommendation for maintaining trained proficiency [Ref. 9]. Therefore, essential task elements which determine success or failure of a mission must be identified and stressed in proficiency analysis, training and/or retraining. Performance measures should be

designed to analyze an operator's capacity to perform those aspects which are identified as being critical. A study of these four categories will provide valuable information for building a complete training/retraining program.

A. AMOUNT OF TRAINING

The process of learning is vague and ambiguous because every individual learns at a rate and sequence different from others. Many factors affect the rate of learning and cause a fluctuating progression. Therefore, an idealistic smooth graphic that represents an average person with average skills will be developed.

In Figure 1, the trainee begins training at time 0. Because of diversified educational backgrounds, it is assumed that there is no knowledge level 0, resulting in the graphic displaying a slight positive knowledge level. The curve indicates a rate of learning, with rate being defined as a total quantity per unit of time. Any point on the rate curve identifies a percentage of ideal knowledge with ideal knowledge representing 100% of knowledge attainable. As time is invested in training, an increase in knowledge is recognized. Note that the initial learning rate is much more rapid and, as time passes, the rate lessens until it becomes asymptotic with the ideal knowledge level. This optimal level will never be reached due to many external contingencies such as trainee peripheral interests, changing state-of-the-art instructional aids, knowledge of instructores, and other

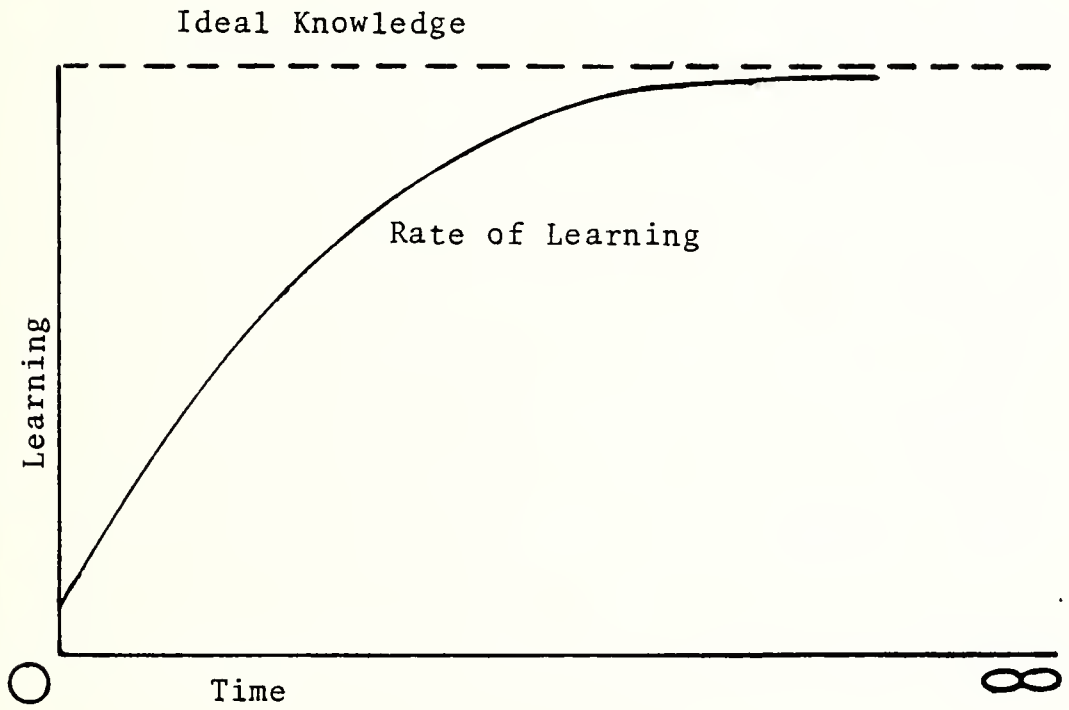

Figure 1: A Typical Learning Curve

reasons which will be discussed later. However, for simplicity, it is assumed that these factors have been reduced and the ideal knowledge level may be almost attained.

B. DURATION OF RETENTION INTERVAL

As discussed earlier, the primary factor causing skill deterioration is a function of the final skill level attained prior to non-use as related to an inverse relationship to time, defining deterioration rate. From person to person, the deterioration rate will vary. This deterioration occurs at a fluctuating rate, represented by less than a smooth curve. For simplicity, a smooth graphic representing the same average student depicted in Figure 1 will be used in Figure 2.

In Figure 2, it is assumed that the trainee has reached the almost ideal knowledge level discussed earlier. Once this level is identified, the student is removed from the training environment permanently. It is important to note the negative direction of the curve. This depicts the loss of knowledge or the deterioration rate [Ref. 10].

It is important to recognize that the steepest or fastest rate of forgetting occurs in the initial time frame of the curve. As time passes, the trainee will eventually arrive at a residual knowledge/skill level slightly higher than his original educational base at time 0, as indicated in Figure 1. At this undefined point, the knowledge would most likely be obsolete due to changes in technology and state-of-the-art in development.

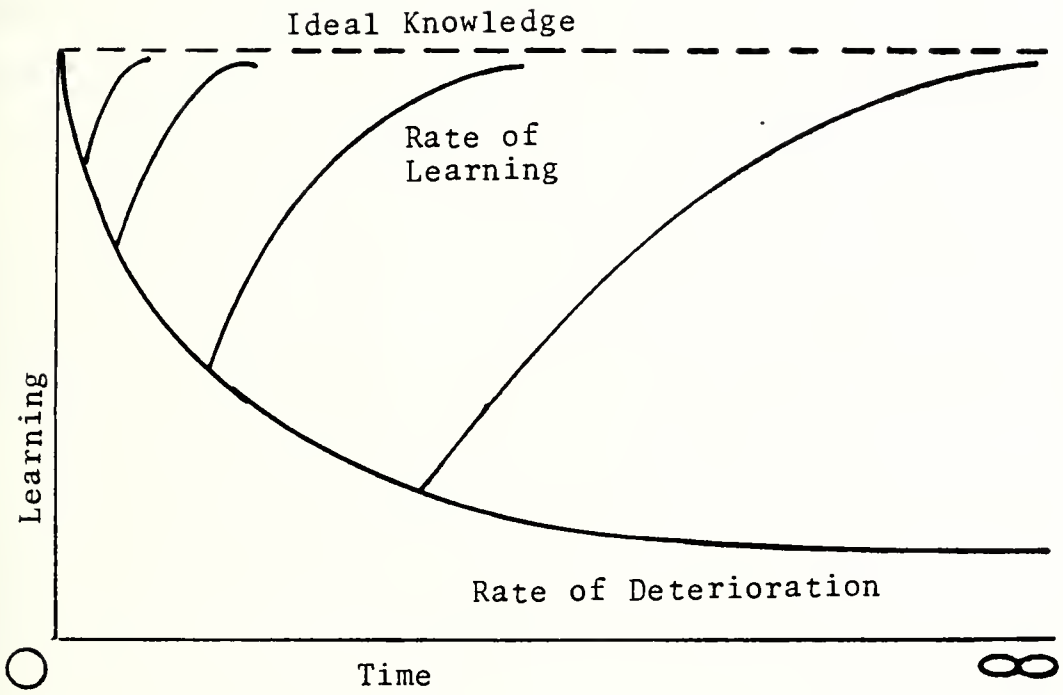

Figure 2: Skill Deterioration Time.

In Figure 2, the rate of deterioration of knowledge is shown by the solid lines. The rate of re-learning at any given time is expressed by the curve rising from the deterioration curve at that time.

With time, the reduced skill level that is reached may be countered by retraining that will return the student to his original knowledge level. This relearning curve represents the rate at which the knowledge is regained [Ref. 11]. The longer the non-use period is, the less knowledge is retained. The retraining time necessary will increase at a proportional rate to the non-use time. At some undefined time, the relearning curve will be equal to the original learning curve because of complete deterioration and obsolete original skills.

1. Learning Levels and Deterioration of Skills

Now that the basic concepts of the learning and skill deterioration curves have been discussed, some very realistic and significant conclusions can be reached by using simple comparisons.

In Figure 3, the two curves of learning rate and skill deterioration have been scaled together. Having identified the two variables of time and original knowledge levels as the prime factors, an estimated level of knowledge at a given period of time can be calculated.

In cases involving the necessity to determine the original knowledge level, the use of Figure 4 will assist in determining skill loss. Learning levels have been determined as LL1, LL2, LL3, and Ideal Knowledge. If the student follows the learning curve, then an LL will be attained at an associated time. With the use of Figure 5, the LL is transposed to the

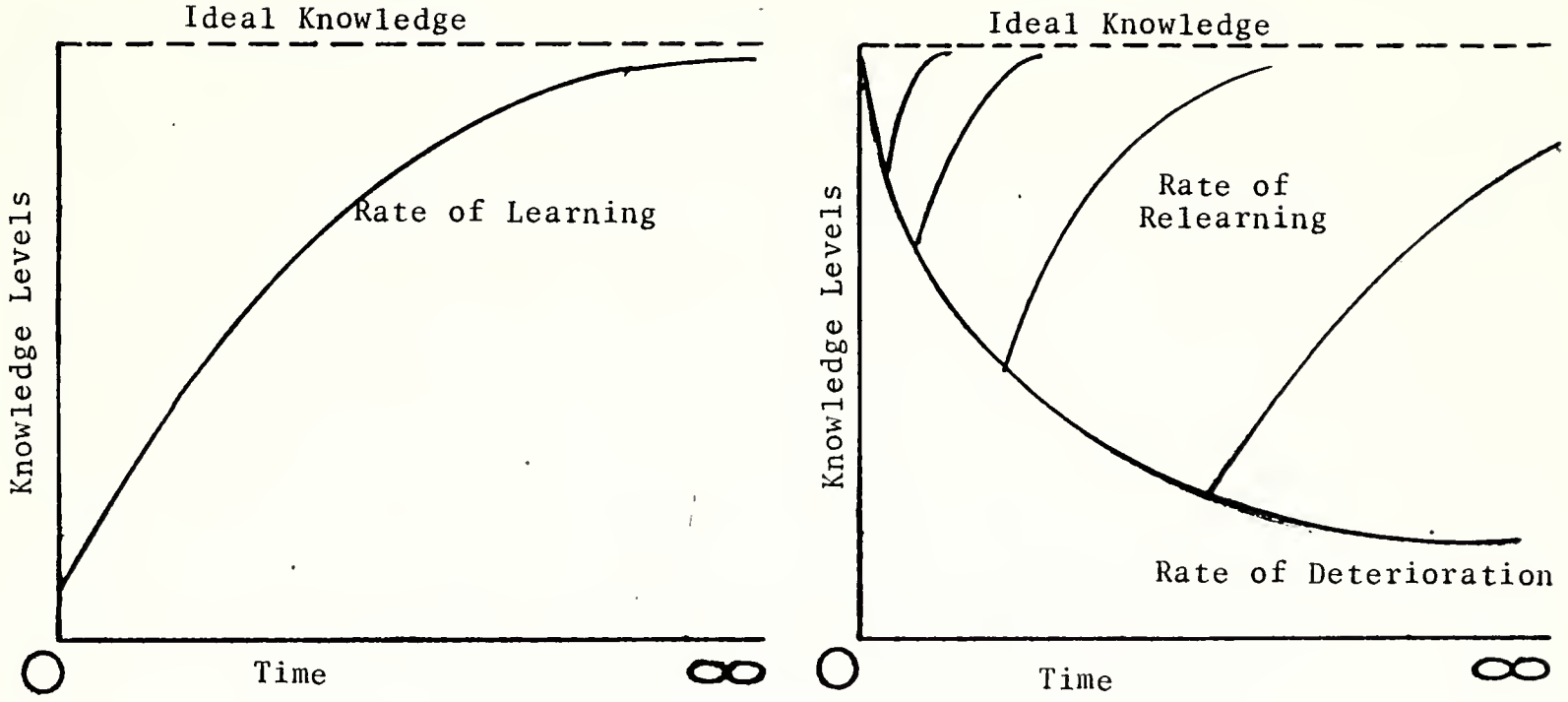

Figure 3: Comparison between Learning Curve and Skill Deterioration Curve.

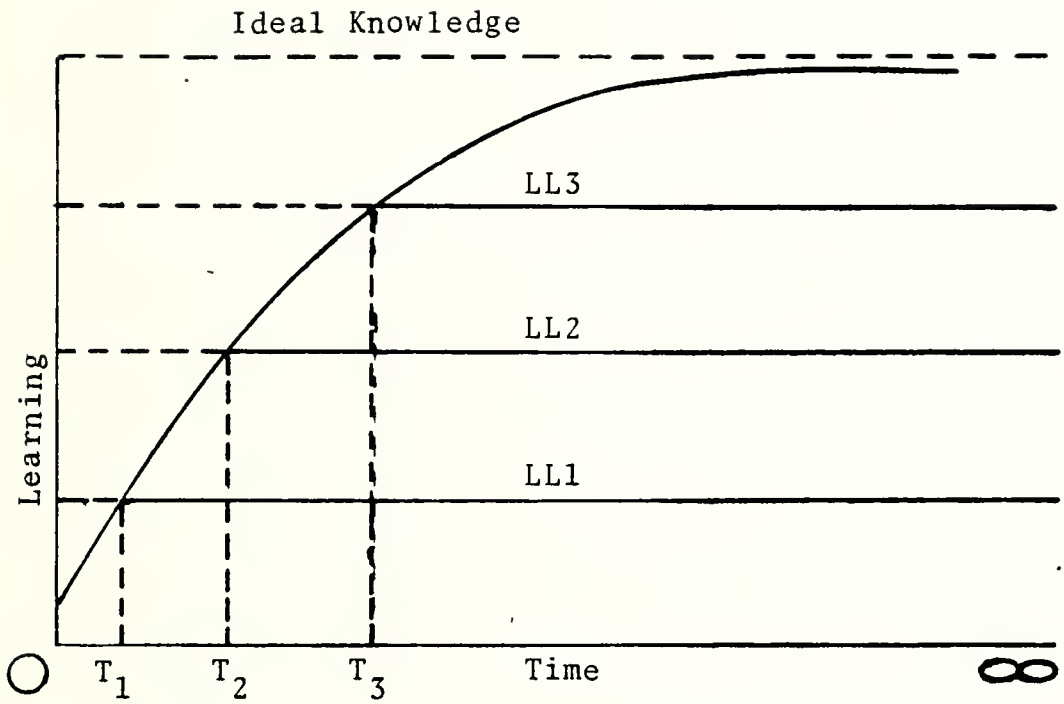

Figure 4: Original Knowledge Levels.

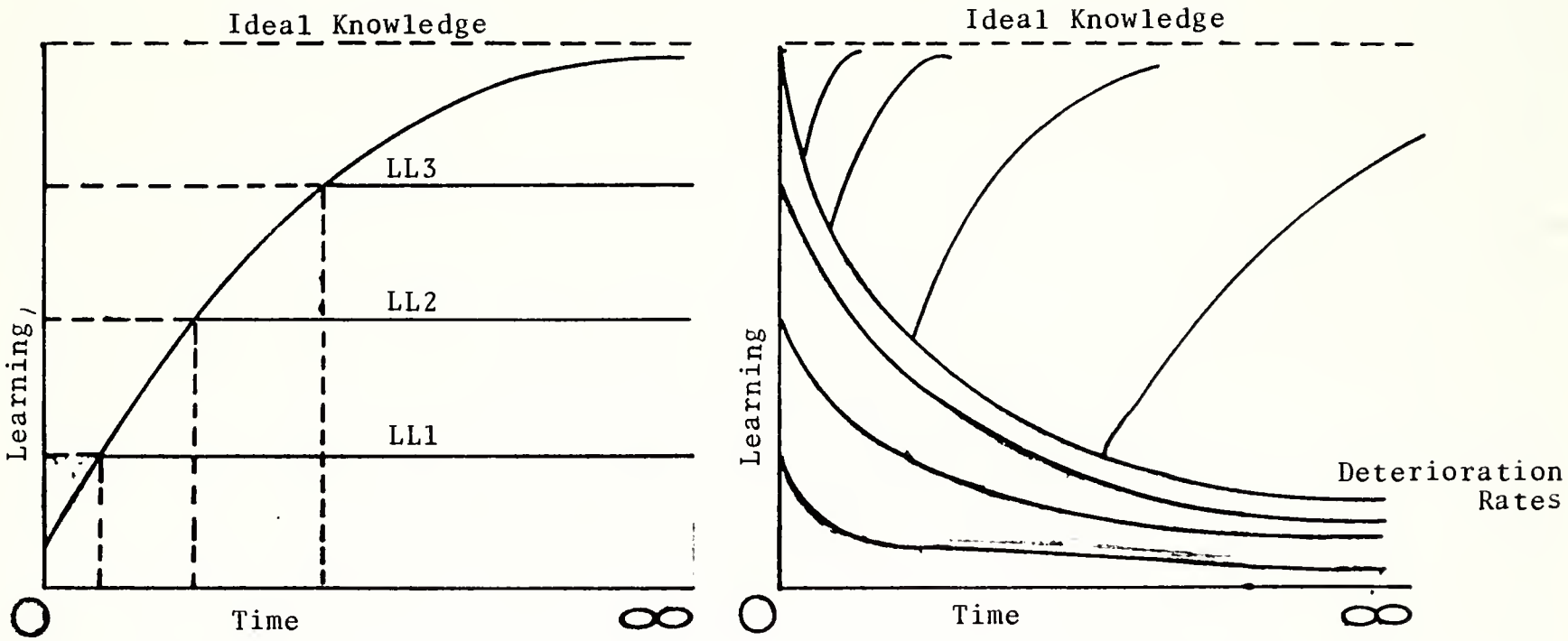

Figure 5: Associated Deterioration Rates for Differing Levels of Original Knowledge.

deterioration graph simulating the assigned knowledge level attained. At LL1, the student has reached only a small portion of the total knowledge available. At this level, his associated deterioration curve will be a sharp decline with total loss occurring in a short time period. As the knowledge level increases through LL2 and LL3, the associated deterioration curves tend to flatten out and the time required for total deterioration increases.

The critical step in the forgetting theory is to identify the actual original learning level. It is correct to assume that the student will never master the total knowledge level, but a level that is somewhat less.

It is necessary to develop an analytical method that identifies whether the individual's trend of improvement is following the learning curve or the deterioration curve. It is assumed that the original training program qualifies a man to perform at a given skill level and that actually working at the job raises this level. The training period is represented by the rapid increase slope in Figure 6. When the training period is complete and the job is being performed, any added knowledge level gained is a function of the skill development and repeatedness of the task.

The time of disuse and original knowledge level present a simple relationship that is easily devised when attempting to identify a position on the deterioration curve. However, other important elements must be considered. The problem is to develop a list of elements that are directly involved

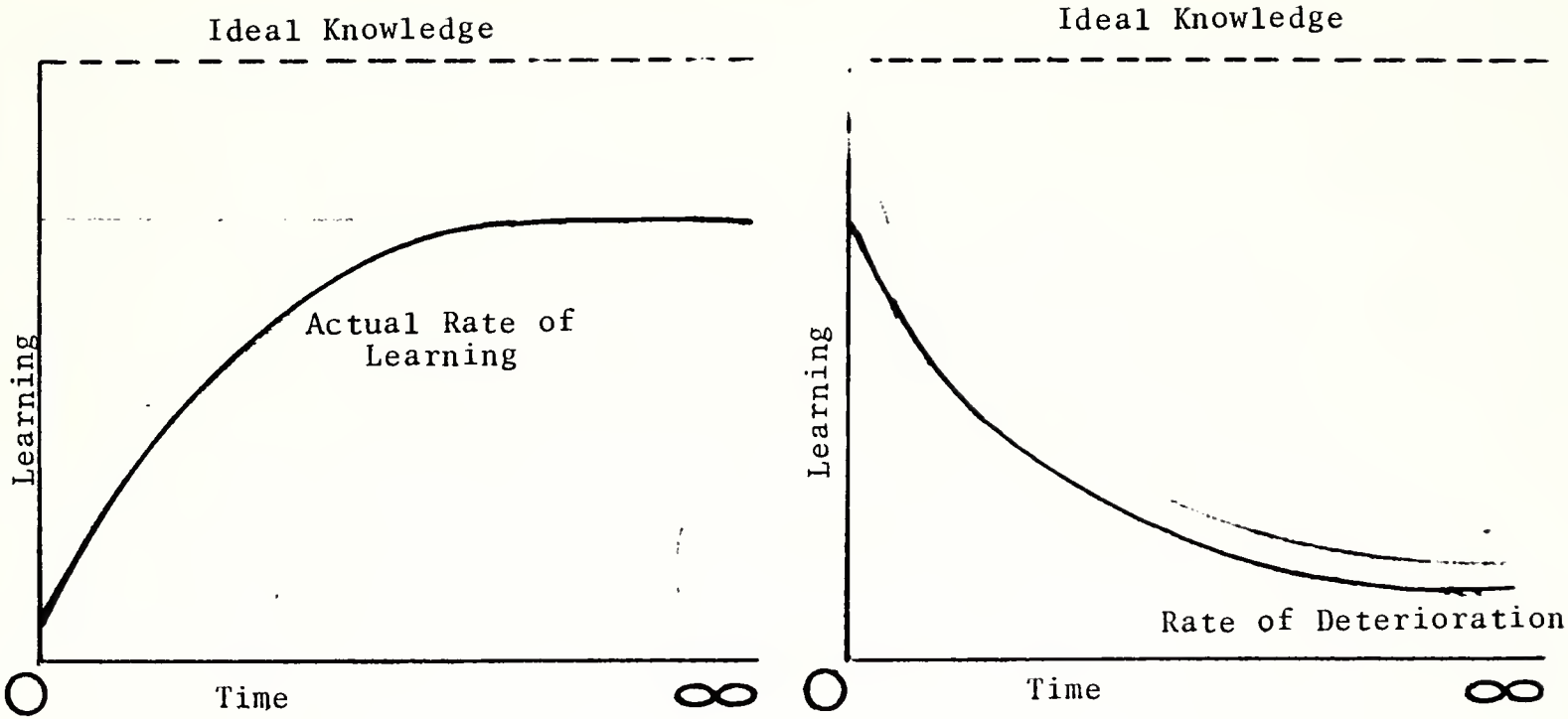

Figure 6: Actual Learning Level and Associated Rate of Deterioration.

with or related to skill deterioration and to provide the structure for evaluating the amount of skill deterioration that has taken place in a particular case. A case is the average worker trained for a specific assignment but not in an environment to use this newly acquired training for an extended period of time as discussed and covered in Figure 2.

The time of non-use and original knowledge has already been considered, so the task organization and task environment remain to be covered. With so little research in this field, these elements can only be compiled through performance indicators, logic, conjecture, and any related research that has been conducted.

C. TASK ORGANIZATION

In the naval aviation maintenance profession, an element list can be produced by analyzing the task requirements of various ratings. The analysis classifies the functions of the job that affect the ability to remember the specific tasks. Once this is done, a predicted performance can be established and a determination of the worker's position on the deterioration curve can be estimated. The major elements that are related to task organization are:

1. Average difficulty level of tasks performed per unit of time;
2. Learning difficulty of job tasks;
3. Probability that job tasks cannot be performed without specialized training;
4. Relative time (experience) required to reach adequate performance;

5. Number of tasks in the job [Ref. 11].

This list is not all-encompassing of the elements of task organization, but it is suggestive of the types of items that should be included. It is apparent that the items are overlapping and are definitive of the type of job being performed.

The number of tasks in the job is perhaps the most influential element in job performance. In the case that the tasks are few, the ability to perform these tasks is obtained faster. Then, the job is repetitious in nature and easily comprehended. An example is the work center that performs scheduled maintenance on aircraft. During the maintenance, the worker follows a written, step-by-step algorithm resulting in rapid mastery of the job. Once this worker masters the required skills, he will retain the knowledge and capability much longer than the worker who has an infinite number of tasks with no identified algorithm to follow. The unscheduled maintenance that is required to maintain aircraft available is an example of such work. This type of maintenance rarely follows a repetitious pattern and must be handled as contingency repair. In some instances, a worker may see a particular task only once in his career. This particular type of task results in rapid performance deterioration.

The other elements discussed identify the difficulty and complexity criteria of the job. The deterioration of performance capability is as important as the reduced knowledge level associated with memory. The higher degree of specialized

skills, complex manipulations, physical constraints, and other unusual factors have immense influence on skill deterioration.

D. TASK ENVIRONMENT

The task environment category represents those elements of the work environment that will influence the ability to perform the routine tasks. Some of these elements are:

1. Rapidity and frequency of changes in technology and work procedures;
2. Degree of ad hoc, ad lib, free-form, unstructured responding and/or performance required;
3. Workload pressures and time factors;
4. Length of disuse period;
5. Likelihood that important job skills will not have been used or rehearsed during the disuse period [Ref. 11].

As in the task organization section, this list is not all-encompassing. The elements directly affect the environment of the tasks and represent a degree of influence. The more difficult these factors are, the less retention the worker will have.

Perhaps the most critical environmental element is that of technology changes. As technology changes, original knowledge is rendered obsolete and retraining is vital. This element is as critical as the elements concerning time and procedure.

Now that all elements and their influence on retention have been discussed, a more accurate skill deterioration curve

can be constructed. In Figure 7, the worker has attained his highest level and is removed from the learning environment. The curve is multidirectional and will vary with the different degrees of task organization and task environment. The skill deterioration rate is slow and reaches a point where no deterioration occurs for a short period of time; then forgetting occurs again. This particular curve represents a small degree of task organization represented by repetitive tasks with a low degree of difficulty. The task environment elements follow a similar reduced degree of difficulty.

In the case of Figure 8, the deterioration rate is much more rapid than in the prior example. This indicates many different, complex tasks in a rapidly moving environment of contingency type aircraft repairs.

Even during the time of training, the learning curve is opposed by the forgetting syndrome. For example, the learning that is done early in the program has an associated deterioration curve toward the end of the program. Evidence of this deterioration can be identified through periodic feedback testing, revealing the knowledge level of the material previously studied.

It is important to consider all factors involved in task performance. The actual dimensions cannot be quantified, but the position of the performer can be identified by relative performance. If performance continues to improve, then the current training program is working satisfactorily. If the

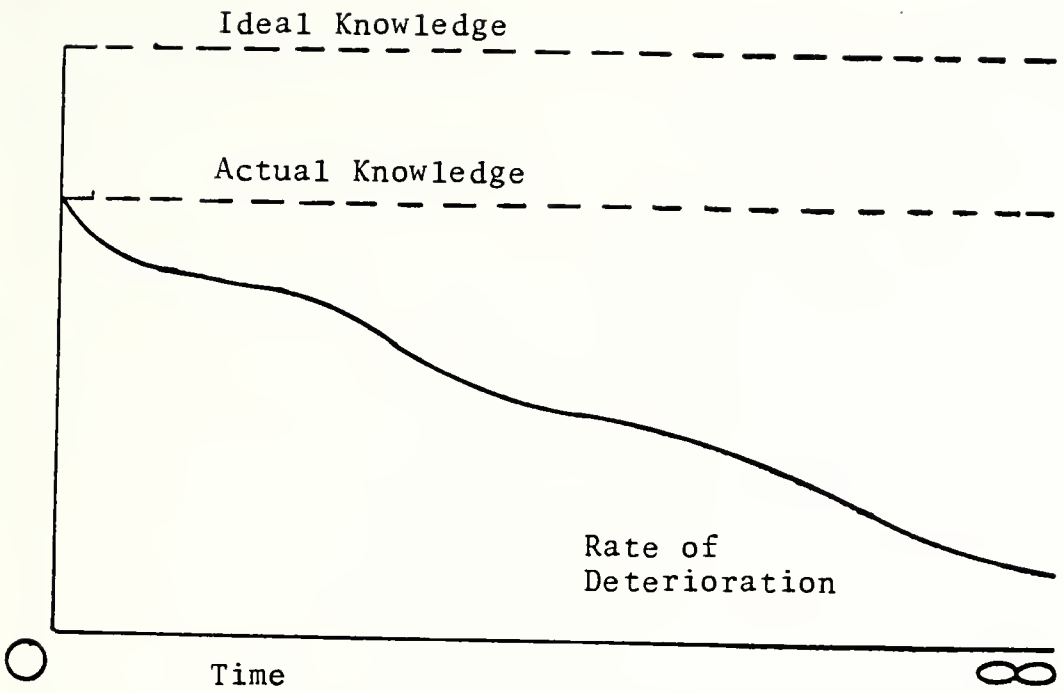

Figure 7: Rate of Deterioration of Repetitive Tasks.

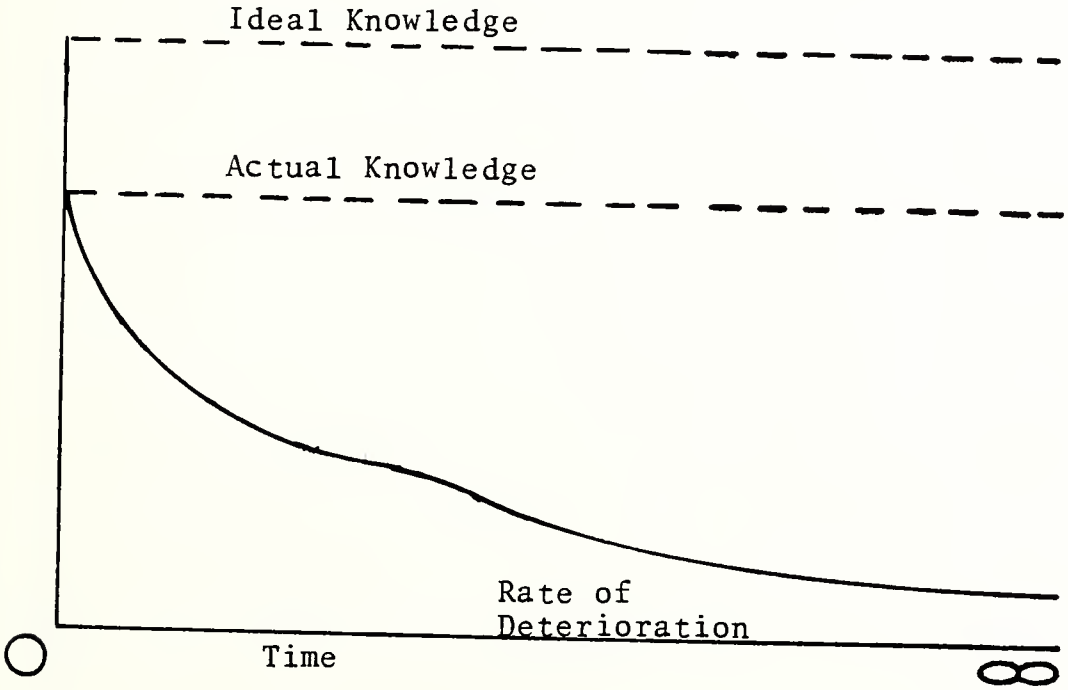

Figure 8: Rate of Deterioration of Complex Tasks.

Note: The downward gradient of the deterioration curve is steeper for complex tasks than for repetitive tasks.

performance is reduced, based on prior performance, then the training program is inadequate. Once on the job, if the worker's performance indicators are not analyzed, it may be discovered that his skills have deteriorated to the point where retraining is necessary.

In the next chapter, a look at performance indicators representing skill deterioration will be analyzed. For this situation, it is necessary to identify whether to train or retrain the worker. In either situation, a look at the conventional, highly reliable training techniques will be discussed.

III. TRAINING

A. TRAINING BENEFITS

Historically, training has proven its benefits as an aid to improving an organization's productivity. The learning and skill deterioration theory presented here typifies the trend of an individual and exposes the need for continual training. In the work center environment, the training program frequently is tailored to several workers rather than the individual. There remains a training gap with an unanswered question, "How can the training be tailored to the individual?" The learning and deterioration theory can be used to find potential training needs for individuals.

Some of the more common and readily observed benefits of training are:

1. Reduced learning time to reach acceptable performance;
2. Improved job performance;
3. Attitude formation;
4. Aid in solving operational problems;
5. Filling manpower needs;
6. Benefits to the employee himself [Ref. 12].

This short list of immediate benefits presents a good feedback system to the managers. In a worthwhile training program, the worker develops the skill necessary to perform his job rapidly and efficiently. Part of this training program is to provide an incentive to learn, perhaps the

offer of a higher position with more pay. As the trainee becomes more diversified in his skills, he should recognize that the market value of his skills increases. It is a function of the training program to encourage this.

B. TRAINING NEED INDICATORS

As may be expected, inadequate training results in overall poor performance on the job. The following are ways of discovering training needs:

1. Identify organizational and production problems;
2. Analyze jobs and men;
3. Collect employee and managerial opinion;
4. Anticipate future organizational and production problems [Ref. 12].

Although organizational and production problems may indicate inadequate management, the need for training is inescapable at any level in the hierarchy. Management's objective is the constant improvement of efficiency. At the first indication of reduced productivity or increased costs, an analysis of cause should identify the problem as either a training need or a result of an external contingency that prevents improved productivity. Further causes of decreased production are the alienation of labor and management, excessive absenteeism, and inability to make the schedule. In order to reverse production slippage, it may be effective to evaluate an entire work group to determine whether or not additional training is needed. It is

essential to know whether the workers are capable of performing the assigned tasks.

Workers tend to be motivated toward training if they have some voice in the development of the program.

C. TRAINING METHODS

A vital necessity in maintaining a high readiness capability in an aviation activity is the presence of competent maintenance personnel. Through the years, it has become obvious that the only way to obtain and maintain competency is through a large-scale systematic training program.

Historically, the words education, development, and training have been used more or less interchangeably. To avoid confusion these three words are defined below in the context of this research:

> Education consists of imparting knowledge or concepts which a person may apply to diversified, wide-ranged areas.
>
> Development is a similar concept placing more emphasis on the fact that a person is able to evolve into higher capabilities then before through a combination of productive education and positive experience.
>
> Training is the organized procedure by which people learn knowledge or skills for a definite purpose [Ref. 13].

It should be noted that education is the base with training as a follow-up mechanism that is narrower in scope and is frequently vocational. Development is the growth of knowledge and professionalism resulting from the combination of education and subsequent training coupled with experience.

In the vocational environment, increased productivity is contingent on the individual's development in his field of specialty. In order to develop continually and progressively, training is necessary.

When considering the formulation of a training program, the different methods of training should be reviewed and the types found to be most beneficial should be included to maximize productivity of the program. Four general training categories normally accepted in business apply to aircraft maintenance training. These methods are:

1. One-the-Job (OJT)
2. Vestibule
3. Classroom
4. Other

These training methods are useful in all professions. Certain aspects of all of these methods are used in aircraft maintenance training programs.

1. On-the-Job Training

OJT is the most prevalent type of training used. No school is necessary, just a need for work and a person to perform it. However, different methods are used to perform OJT. Perhaps the most beneficial method is to have an instructor assemble all the necessary equipment, procedure references, working materials, and any other required training aids. To effectively teach, he must break down the material to be learned into meaningful packages and present it to the subordinate in a manner appropriate to the job to

be learned. If the job is a simple repair, it might be a one-step procedure. If the job is complex, then a sequential-step procedure will provide a longer-lasting understanding to the subordinate.

When OJT is conducted, training aids such as flow charts, manuals, pictures, demonstrations, oral and written explanations, tape recordings, and movies can be of great assistance [Ref. 12].

OJT is appropriate for teaching knowledge and skills that can be learned in a short time and when the number of subordinates is few. The larger the group, the less knowledge will be transmitted to the individual. It is good for repetitive unskilled and semi-skilled manual jobs.

A disadvantage is that OJT is inadequate for highly skilled, technical, professional, and supervisory positions. They require a more complex educational background which must be acquired elsewhere. However, the applied aspects of these positions are present on the job. Perhaps the greatest disadvantage of OJT is the fact that the training will be only as good as the instructor's demonstration. If the demonstration is sloppy or disorganized, it may transfer improper maintenance procedures to the worker.

In the long run, OJT is a simple, rewarding, and inexpensive method of training. It can be accomplished during routine scheduled or unscheduled maintenance, or it may be done at any time a supervisor has time to assist in training his subordinate. Through the use of OJT, the worker gains

visual, conceptual identities with the task, resulting in longer-lasting memory.

2. Vestibule Training

Vestibule training uses a classroom environment and is primarily for semi-skilled production and clerical positions. It uses an introductory-course approach in that personnel are given a short course under office conditions. The name is derived from the meaning of vestibule or entrance hall where facsimile equipment for training purposes was originally located. This training usually lasts only a few days or less. It is very similar to the OJT discussed earlier, but vestibule training is desirable for those situations where incorrect procedures by the person being trained on the job could result in harm to himself or to expensive machinery [Ref. 12].

The major advantage of vestibule training is that it is appropriate for large groups. Through the use of this program, theory and technical areas can be easily studied and real job-type production can be duplicated. It gives the trainee the hands-on type experience to facilitate a longer memory span and reduce the skill deterioration rate during non-use.

3. Classroom Training

Classroom training, the most popular method, is the typical schoolroom procedure that most people encounter during maturation. This method is useful for any type of knowledge transfer. It is especially effective for technical

and theoretical materials. The lecture method is the standard instructional style employed in most schools. It utilizes a formal presentation by an instructor who is considered to possess considerable depth in the subject matter. This program often uses both textbooks and lectures by an instructor. The standard procedure is for the student to take notes on the pertinent data and review them for the purpose of testing by the instructor. The advantage of this method is that it can facilitate large groups.

A disadvantage of lecture-type training is that the subject matter must be geared to a particular level of knowledge, normally the middle of the students' knowledge range. Consequently, if the range is too diversified, the upper and lower students will suffer from boredom or lack of interest resulting in less knowledge transfer. Another major disadvantage is that the lecture tends to be a one-way communication process with the only substantial feedback being the test. This results in a memorization situation that will put the trainee on a fast deterioration rate if follow-on training is not used. The most fruitful use of the lecture is to combine it with another form of training that offers hands-on and visual contact.

a. Conference Method

Another type of classroom training is the conference method. This style includes a group meeting conducted according to an organized plan, in which the leader seeks to develop knowledge from oral participation

of the students. Another name commonly associated with this method is seminar. Through the use of seminars, learning is developed through building upon the ideas discussed by the student members. In essence, the people learn from each other while being directed by the leader.

There are three basic types of conferences. They are: (1) directed conference, (2) consultative conference, and (3) problem-solving conference. The most commonly used conference for training is the directed conference, also known as the guided conference. The leader guides the group to ensure that certain concepts are discussed. The consultative and problem-solving conferences are not normally used for training purposes but for solving management and production problems, respectively [Ref. 12].

The features used to format the directed conference for training purposes are extremely important to maximize the knowledge transfer and optimize the students' understanding. The group size should be restricted to less than twenty people because the success is dependent on active participation. To encourage participation, the students should be seated facing one another so they talk to each other rather than directly to the leader. The student should come to the class prepared with background information on the subject to be discussed. Background material is usually obtained from literature which the student is given before the conference. During the discussion, the instructor artfully uses questions to stimulate class participation. The use of visual

recording such as blackboard writing prevents redundancies in material covered [Ref. 14].

There are several advantages to seminar training. A properly conducted program will completely dissect a topic because of the diversified opinions of the trainees.

During the discussions, a person who has experience with the subject can share the lessons he has learned with the other members of the group.

There are also some disadvantages to this method. For example, it is most effective with a small group. The progress is frequently slow because a well-led group allows all members to contribute their opinions. It is sometimes difficult to prevent the discussion from wandering to irrelevant issues.

Overall, the directed conference is a very effective training aid. A further use of this method is the case study.

b. Case Study Training

The case study refers to an actual situation that has occurred. The student analyzes the situation and recommends an alternative course of action. This method is used extensively in vocational areas and provides an excellent building of conceptual and management skills. The conference atmosphere assumes that there are no right or wrong answers, but there may be several approaches to problem solving. The advantages of this method are evident. The individual should develop an analytical capability as he

deals with real problems. The object is that he should react properly in the event that a similar situation occurs in his own work experience. Another advantage is that the case method is an excellent means for integrating the knowledge obtained from a number of foundation disciplines.

The case study disadvantages are similar to those of the conference. The groups must be limited in size as group participation is a key factor. In order to be effective, the group requires certain background information and analytical skills.

c. Programmed Instruction

The programmed instruction method has become a cornerstone in training and worker development. This method gained prominance in the 1950's and has become one of the most popular training programs. The basic function of programmed instruction is to provide a short reading assignment followed by a series of questions. If the student has difficulty with some of the questions, then he is given a more fundamental branch of the program to help him master the questions and understand the material which had been difficult for him.

There are numerous advantages to the program. The student is self-paced and the instructor plays a different role than that of the key teaching aid. With this feature, one instructor can facilitate a very large group. Another distinction of this program is that the material is broken into very small units that build upon the prior units. The effectiveness of the program rests in the fact that the

trainee is given immediate results in his answers and is able to continue as rapidly as his abilities allow. If there are any problems continuing the instructor is present for assistance.

Although programmed instruction has had highly favorable results, a few problems may be encountered. The initial problem is to maintain the proper pace for each individual participant. If there is lack of motivation, it may be difficult to achieve the level of training desired. This could result in inequitable returns because the construction of the programmed text tends to be very expensive. This program does stimulate motivation in most cases because it can be completed almost anywhere. However, because of its memorization nature, resultant learning tends to have a more rapid deterioration curve.

4. Other Methods

This section includes those methods used as instructional aids that do not fit the characteristics of the aforementioned programs.

a. Demonstration

Demonstration uses the sense of sight which results in the longest range of memory. In a demonstration, the instructor performs the actual task while the student watches. This is not to be confused with OJT where the trainee performs the work while the instructor watches. The instructor may supplement this method with the use of models, publications, or any other medium to convey the proper procedures.

The demonstration method is more beneficial when it is used as a supplement to other techniques such as lectures, pictures, text material, and discussion [Ref. 12]. The demonstration method provides for longer-range skills, resulting in a slower deterioration rate.

The main disadvantage of demonstrations is that the circumstances in which they can be used are limited. It is difficult to provide a demonstration for principles and theories. However, it is excellent for mechanical and clerical training.

b. Simulation

A simulator is a piece of equipment or a technique which duplicates as nearly as possible the actual conditions encountered on the job. The use of the computer has developed highly sophisticated skill improvement games such as programs that simulate real-world situations.

This type of training is highly motivational because of the game-like nature. It is an excellent program to use when human error during training might result in potential destruction of costly equipment. The result is that the material covered has immediate feedback and frequently an instructor is not necessary. Because of the sight-sense factor, it enhances long-term memory, resulting in a longer-ranged deterioration curve.

D. TRAINING PROGRAMS

The principles of learning, memory, and training methods can only be useful if they are considered as contributors to the training program. It is important to realize that a training program that is effective in one environment may not be effective in another. This research is not designed to be a cure-all for the training needs of the world but a study of the major factors to consider prior to building the program for a given situation. Through the use of the learning and forgetting theory, a job may be classified and associated to a learning rate and the associated deterioration curve. The analysis of the tasks performed will identify the need for a combination of the training methods discussed and lead to a more efficient worker.

The next step in organizing the training program is to evaluate the performance tasks of the work center. In essence, in order for the training program to be successful, a system for continual analysis of performance is necessary. Through the use of the analysis program, continual routine training can be conducted.

IV. CONCLUSION

The need for training is evident in every walk of life. In order to maintain proficiency in a skill, the use of that skill is necessary. In the case of vocational professions, hands-on experience is necessary for maintaining a long-lasting skill development. However, in the vocation of aircraft repair, it is necessary to understand the theory behind the tasks performed.

A. APPLICATION

As the technology of the P-3 aircraft has continued to grow, the knowledge base of the squadrons' maintenance departments has diminished as a result of the restructured manning levels discussed in Refs. 3 and 4. Reference 11 presents the indicators that prescribe training needs. These indicators currently exist in the P-3 community [Ref. 15]. It is difficult to prove that a lack of training is the direct cause of these inefficiencies. However, Ref. 16 states that squadron training programs are weak to nonexistent.

A P-3 squadron's maintenance department consists of specialty jobs that are both technical and clerical in nature. The training requirements can be met through the training methods discussed in Chapter III. For example, technical skills developed through lectures supplemented with demonstration provide a means of increased skill retention. Once the

skill is developed, OJT in the skill provides repetitive tasking that further develops proficiency.

It is necessary for the individual command to evaluate its own training needs and apply the combination of training methods to fit those needs.

B. RECOMMENDATIONS

The use of research for building a foundation for new programs has frequently been overlooked. However, the theories presented in this research provide a common-sense approach for improving maintenance proficiency. Through the application of these theories, simple adjustments to the current training program will result in immediate positive results.

1. Pipeline Adjustments

The first step to take in order to improve the maintenance department proficiency is to revamp the current pipeline. Under the current system, the new recruit has potential time gaps in his training process that prove to be contrary to the skill deterioration theory. It is imperative that the new recruit be locked into a continual process from the time that the specific systems education begins until he is a functional performer in the work center.

a. Non-Designated Airman

In the case of the non-designated airman, the specific training begins upon arrival at the FRAMP. The proposed change is to increase the length of his FRAMP assignment to provide time for temporary additional duty (TAD) to station

support activities as necessary. This assignment will be made prior to commencing the FRAMP training. When the TAD is completed, the airman will attend the established FRAMP program and transfer to the squadron primed for work center assignment.

For improved skill development, the squadron must provide an indoctrination syllabus to be completed by the airman to increase his performance of the job. The content of the syllabus should integrate the training methods discussed in Chapter III with the goal of stimulating long-term skill retention.

b. Designated Airman

The specific field pipeline portion of training for the designated airman is initiated outside the P-3 community's control. In this case, the proposed pipeline training differs from that offered the non-designated airman. It is difficult to prevent a time gap between the "A" school and beginning FRAMP short of moving the "A" school to the same location. An improved avenue is for the "A" school graduate to attend FRAMP immediately upon arrival in the P-3 community. When he completes FRAMP, he should be directed to the squadron for assignment to a work center as soon as possible. Once he is in the squadron, the indoctrination syllabus will provide the additional training necessary to increase his skills to an acceptable level. Hands-on job experience will provide the required residual skills to enable the airman

to perform at a satisfactory level upon return to the squadron from TAC assignment.

c. New Supervisor

It is important to differentiate the levels of supervisors for the purpose of pipeline analysis. The supervisor has been defined as E-5 and above. He is either a senior member of the work center or the Work Center Supervisor (WCS). The WCS is normally the senior member.

The current training pipeline provides adequate training for the supervisor because he possesses the necessary skills and technical background to comprehend the content of FRAMP training. The squadron is tasked with developing these skills to familiarize the supervisor with the intricacies of the aircraft systems and squadron operations. It is necessary for the supervisors to complete the indoctrination syllabus and provide hands-on training. The follow-up training will enhance further development of professional capabilities. In the case of non-P-3 experienced supervisors, a more detailed training syllabus is necessary.

2. Follow-On Training

The mean time for repair has reached an all-time high in recent months. This situation has created a need for examining training programs [Ref. 15].

The authority to improve this situation rests with Commander, Patrol Wings Pacific (CPWP) and his staff. It is imperative that follow-on training be given the highest priority within each command. CPWP should set guidelines for

the program to be enforced by a training staff for the commands. The proposed training program must provide proficiency analysis of mission failures as discussed in Refs. 8 and 9 and tailor the necessary training/retraining needed.

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